

Geosci. Model Dev. Discuss., referee comment RC2
<https://doi.org/10.5194/gmd-2020-435-RC2>, 2021
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Comment on gmd-2020-435

Anonymous Referee #2

Referee comment on "Non-Hydrostatic RegCM4 (RegCM4-NH): model description and case studies over multiple domains" by Erika Coppola et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2020-435-RC2>, 2021

The paper "Non-Hydrostatic RegCM4 (RegCM4-NH): Model description and case studies over multiple domains" describes the extension of RegCM4 with a non-hydrostatic option. Three case-studies are presented which all feature heavy precipitation events in different parts of the world.

General comments:

The paper could make a valuable contribution to the community, but it seems unfinished and needs major improvements.

The current manuscript needs a general language check. One can often find slips like additional blank spaces or inconsistent naming. Just to give one example: The term convection-permitting is used often in the text but sometimes with and sometimes without hyphen. It feels like the text has been written by many different people, which is not a bad thing at all, but it adds to the impression of being unfinished. Some sort of harmonization by one author would increase readability and consistency.

Another aspect that makes the manuscript look unfinished is the fact that some features of the model are explained in great detail, but others are completely left out. The title reads "Model description". I do not expect that all components are described in great detail, but at least a table listing all model features such as radiation scheme etc. with references where to find a description would be nice. Not everyone knows RegCM4 and searching all the other references for the bits and pieces is quite cumbersome. What is the time integration scheme?

Specific comments:

Line 24: Delete "the" in front of the first RegCM. What does RegCM stand for?

Line 50: Do you mean "bias compared to observations"?

Lines 65-67: The mentioning of Grell et al. (1995) seems redundant in this sentence.

Line 68: Do you mean "same grid and variable structure as RegCM4"?

Line 229-231: For the Texas case you used ERA-Interim directly. Can you also motivate this decision with spatial spin-up and the work by Matte et al. (2017; DOI: 10.1007/s00382-016-3358-2)?

Table 1: Can you add the domain sizes.

Figure 2: Numbers and texts around the sub-figures are too small. Is it possible to use a common label-bar and the same contour intervals? This would make it easier to distinguish different orographic features in the domains. In section 3.1 you describe the Russian River. Maybe it is worth to already indicate it here, as not everyone is familiar with California.

Figure 3: Numbers are too small. What does the arrow length mean? I find it hard to compare the maps a) and b) with c). Can you either choose the same section in c) or at least indicate the regions of a) and b) in c) with a square.

Line 271: Delete "the" in front of land.

Line 274: Do you mean "same variables from ERA5"?

Figure 4: Numbers are too small. I would recommend to split the figure and treat each region separately. All cases use different observations or analysis products and one case does not have a corresponding hydrostatic run. Keeping everything in one figure is not helping the reader, but tends to confuse. What are the resolutions of the observations/analysis?

Line 319: Is the comparison to ERA-Interim really fair given that the jump in resolution is rather extreme? One could even argue that the precursors are in ERA-Interim, because the downscaling captures the event.

Line 329: "The RegCM4-NH simulation shows a more realistic temporal evolution than the RegCM4, ..." Did you mean ERA-interim instead of RegCM4? I thought there was no (hydrostatic) RegCM4 simulation.

Line 360: Can you motivate the choice of 26°C for the lake temperatures with observations?

Figure 6: Numbers are too small. Coastlines are very hard to see. What does the arrow length mean?

Line 374: Can you indicate the cross-section with a line in Figure 6

Line 393: Replace "and this" with "which".

Lines 394-395: This sentence is hard to understand. Do you mean that the maximum is captured but the pattern shifted to the south? Please rewrite.

Line 398: Delete "overall"

Line 399: Delete "that"

Section 4: The first paragraph needs a complete revision. I find many formulations hard to understand (e.g. the sentence from line 406-408). I can only find one conclusion that basically reads that non-hydrostatic models are better in simulating convection than coarser hydrostatic models. This is not new and obvious to me. I'm not saying that a model description paper needs groundbreaking conclusions. I rather like to encourage the authors to think about the possibilities the new system is opening up and how this system can add to the challenges around local climate change. The second paragraph is touching this topic and maybe the authors can expand on this. I would even wish for a short section in the main text on the performance of the model on climatic time scales.